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I am indebted to the generosity of Dr. Keivin Burns for the plates on which the photographs were made Dr. Burns is at present contributing his services as a special investigator at the Lick Observatory, for the purpose of photographing various celestial spectra in the near infra-red. To his especial skill in preparing plates of extreme sensitivity to the longer wave-lengths the success of these preliminary observations is largely due.

December, 1919. W. H. WRIGHT.

PRELIMINARY NOTE ON THE VARIATION OF LATITUDE

The variation of latitude for this station can be derived from the observed motion of the pole of figure about the pole of rotation of the Earth. The coördinates of the observed rotation have been reduced, up to the epoch 1918, and have been published in various issues of the *Astronomische Nachrichten*. The discussion made here recently of this published material gives the following expression for the variation at this station, from 1890 to 1914:

$$\begin{aligned}\phi-\phi_0=+0''.02+0''.15\cos(t-1902.05)303^\circ\\ +0''.06\cos(t-1902.3)\,360^\circ,\end{aligned}$$

where t is expressed in years; and the computation has been made for every tenth of a year. The coefficient 303° corresponds to a period of 1.19 years, derived from the observed values up to 1918, with a probable error of less than ± 0.01 year. The published material includes the data from over twenty fixed observatories, and from eight international latitude stations where zenith telescope observations have been made. The average difference between the values of $\phi - \phi_0$ derived from the observed coördinates of the rotation and from the expression above is $\pm\ 0''.04$. The average value of $\phi - \phi_0$ is $\pm\ 0''.12$, which is three times the average deviation of the computed values.

The extensive investigation of the variation of latitude by Dr. S. C. Chandler resulted in an expression of the variation for a station in longitude λ of the form:[1]

$$\begin{aligned}\phi-\phi_0=-0''.16\cos[\lambda+(t-2411790)0^\circ.85]\\ -r^2\cos(\odot-G),\end{aligned}$$

where t was given in days. The expression consists of two terms, one having a period of 427 days (fourteen months), and the other an annual period. These terms closely resemble those derived here for the observed material up to date, except that the period of the first term has been increased to 434 days, and the coefficient of the annual term is now smaller than that derived by Dr. Chandler up to 1894, $0''.06$ in place of $0''.11$ for this station.

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[1] *Astr. Jour.*, **14**, 141, 1894.

The fourteen-month term was originally quite precisely 1.17 years, and the small change of two hundredths of a year when carried thru the total interval of 28 years amounts to over half a year in the computation of the values of the so-called fourteen-month term. This would result in a complete reversal of the signs of the computed variations for the fourteen-month term, since the values rise from zero to a maximum in 0.3 year, and pass from maximum to minimum in 0.6 year. This explains the discrepancy between the variation observed here with the meridian circle in 1917 and 1918, and the values of $\phi - \phi_0$ from Chandler's original formula.[2]

Taking the reduced value of the coefficient, $0^\circ.83$ in place of $0^\circ.85$ of Chandler's expression, to conform to the later data, with $\lambda = 122^\circ$, $r_2 = 0''.11$ and $G = 197^\circ$ for Lick Observatory, the values of $\phi - \phi_0$ for every tenth of a year have been computed up to 1918. The average difference of accidental character between the values from the observed coördinates of the polar motion and those from the revised formula is $\pm 0''.05$. Some mean differences of a systematic character appear in the later years, when values of the z term as large as $+ 0''.08$ are given for a single year.

The values of the latitude observed here in 1917, when compared with the expression representing the observed coördinates of the pole of figure, have an average derivation of $\pm 0''.08$ for a group of eight nights, while the average residual from the mean ϕ is $\pm 0''.14$ for the same groups. The latitudes observed at the international latitude station at Ukiah, in the same period, agree with the variations in the computed expression with an average deviation of $\pm 0''.02$. The average difference of the variations, as observed at the two stations, is $\pm 0''.08$. The differential observations with the zenith telescope are more precise than those made with the meridian circle, in which systematic errors of fundamental declinations and of refraction have more pronounced effect.

R. H. TUCKER.

January 19, 1920.

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[2] *L. O. Bull.*, **10**, 36, 1919.